emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power. On the report form, simply check off Emergency or Commercial for the Power Source and be sure to specify your ARRL operating class (2A, 1C, etc.).

Satellite Summary and Log Submissions

The Satellite Summary Sheet should be used for submission of the AMSAT Field Day competition and be received by KK5DO (email or postal mail) by 11:59 P.M. CDT, Monday, July 11, 2016. The preferred method for submitting your log is via e-mail to **kk5do@amsat.org** or **kk5do@arrl.net**.

You may also use the postal service but give plenty of time for your results to arrive by the submission date. Add photographs or other interesting information that can be used in an article for The AMSAT Journal.

You will receive an email back from me within one or two days after I receive your email submission. If you do not receive a confirmation message, then I have not received your submission. Try sending it again or send it to my other email address.

If mailing your submission, the address is:

Bruce Paige, KK5DO
Director of Awards and Contests
PO Box 310
Alief, TX 77411-0310.

Certificates will be awarded to the first place emergency power/portable station at the AMSAT Space Symposium and General Meeting in November 2016. Certificates will also be awarded to the second and third place portable/emergency operation in addition to the first place home station running on emergency power. A station submitting high, award-winning scores will be requested to send in dupe sheets for analog contacts and message listings for digital downloads.

You may have multiple rig difficulties, antenna failures, computer glitches, generator disasters, tropical storms, and there may even be satellite problems, but the goal is to test your ability to operate in an emergency situation. Try different gear. Demonstrate satellite operations to hams that don't even know the "hamsats" exist. Test your equipment. Avoid making more than one contact via the FM-only voice hamsats or the ISS, and enjoy the event!

Working AO-85 Full Duplex with Chinese-Made Handhelds

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For many years, our FM satellites – SO-50, AO-27, AO-51, SO-67, HO-68, and even going back to UO-14 – were all V/U satellites. We transmitted to the satellites on 2 meters and listened to them on 70 centimeters. Other than the ISS cross-band FM repeater that operated in the mid-to-late 2000s in a U/V configuration, no U/V FM satellite has been available since SO-35 ("SUNsat") between 1999 and 2001. Many radios, handhelds in particular, used to have the ability to work these satellites full duplex. This feature is not available in most handhelds now, even though some advertise it. With one exception for the handhelds in current production (the Kenwood TH-D72A), none of these handhelds can work the V/U FM satellites in full duplex. Working a U/V FM satellite full duplex is another matter, and, during the past year, I have seen some Chinese-made 2m/70cm FM handhelds that should be able to work a U/V FM satellite full duplex.

With AO-85, we now have a U/V FM satellite, and I have taken this opportunity to try a few of these Chinese-made handhelds to see how they handled working AO-85 full duplex. Since 2013, a few Chinese-made handhelds have been advertised as capable of operating cross-band full duplex. If true, this would be perfect for our FM satellites. With four of them I have tested, and will write about here, none of them could handle working SO-50 full duplex.

Working AO-85 is a different story. Radios like the TH-D72A can work AO-85 full duplex without problems. What I wanted to see for myself was whether these newer Chinese-made handhelds could do so. Knowing that we were getting a U/V FM satellite launched, I bought these four handhelds over the past 18 months:

- AnyTone TERMN-8R
- Puxing PX-UV973
- Wouxun KG-UV8D, and
- Wouxun KG-UV9D

As I tried working AO-85 with each of these handhelds, I used the same settings for some key parameters to set a level playing field as much as I could. For example, each handheld was connected to my Elk 2m/70cm log periodic antenna. I transmitted in normal or "wide" FM while receiving in narrow FM, used tuning steps for both the uplink and downlink in 2.5 kHz steps (something most amateur handhelds do not support), and plugged an audio splitter into each handheld's speaker jack feeding audio to an earpiece and an audio recorder. This allowed me to make a MP3 audio recording of what each radio heard from AO-85 and hear the downlink myself. I did not need to program any memory channels when working AO-85 with these handhelds. All four of them have two VFOs, and I used both when working AO-85.

In addition to the handheld/Elk combination, I connected my SDRplay SDR receiver to a VHF crossed dipole on a portable mast and tripod. The SDRplay was controlled by HDSDR on my 8-inch Windows 10 tablet. I had HDSDR write an RF recording of each AO-85 pass, so I could hear how each handheld sounded through the satellite on a separate receiver. Between using these handhelds and other radios, I found that I could hear myself through AO-85 with 4-5 W transmitter power when the satellite's elevation

Left to right, the Puxing PX-UV973, AnyTone TERMN-8R, Wouxun KG-UV8D, and Wouxun KG-UV9D. [Patrick Stoddard, WD9EWK/VA7EWK, all photos.]

was at least 20 degrees. I looked for passes where AO-85's elevation stayed above 20 degrees for a few minutes, so I had time to make calls and hopefully log some contacts with other stations.

Once I had established a baseline for how each handheld was configured to work AO-85, and had my independent receive setup operating alongside my handheld/Elk station, I was ready for testing. Before writing this article, I posted a series of updates on the AMSAT-BB list[1] as I tested each of these radios. Along with these posts, I included the recordings I made from each pass worked with these handhelds, as well as photos and other files from my Dropbox space[2].

AnyTone TERMN-8R

The AnyTone TERMN-8R came on the market in early 2015 but was ordered off the market by the FCC because of issues with its certification for use on GMRS and MURS frequencies. When used by licensed radio amateurs on the 2m and 70cm amateur bands, FCC certification is not required, provided the radio meets the technical requirements of FCC Part 97. I bought this radio because it was advertised as supporting cross-band full duplex operation, and I wanted to try it on a U/V FM satellite. I was pleasantly surprised at how well it performed.

I originally tried my TERMN-8R with AO-85 just before the AMSAT Symposium in Dayton. Unable to work any stations in that attempt, I tried again in late November after the satellite was commissioned. I made 5 contacts during a 48-degree pass over the Thanksgiving holiday weekend. I had no problems making those contacts, but I heard some noise early in the pass when I transmitted. This noise went away between AO-85's downlink gaining strength as the satellite went higher in the sky and twisting my Elk to improve the signal in the radio's receiver. One of the contacts, Sawson, KG6NUB, in northern California, was using only 2 watts. When I played the recording from my SDRplay/HDSDR receive station, the audio from the TERMN-8R sounded good.

AnyTone TERMN-8R.

This radio may not be widely available because the TERMN-8R has yet to return to the U.S. market and is not sold overseas because it supports GMRS and MURS frequencies, which are not used outside of the U.S. If a satellite operator comes across one of these handhelds, it should be considered a viable option for working AO-85 (and any other U/V FM satellite) full duplex.

Puxing PX-UV973

The Puxing PX-UV973 entered the market about two years ago, making it the oldest of the four handhelds I tested with AO-85. Like the other Chinese-made radios I tested, the dealers promoted it as having full duplex capability. This handheld also was the smallest of the four I tested, and the least expensive. I bought mine on Amazon.com for $78 a couple of months before AO-85 was launched and tried it on an AO-85 pass in late November 2015. Its performance was lacking, and I did not see the need to try it on more passes.

PX-UV973.

Using the same settings for power and FM bandwidth (wide vs. narrow), I was able to work two stations during an AO-85 pass with maximum elevation of 57 degrees. Unfortunately, the PX-UV973's receiver was the worst of the four handhelds. The receiver was not desensitized while I transmitted, but it performed poorly, even with the stronger AO-85 downlink. Although I could hear myself as I transmitted, the other handhelds' receivers were much better. When I listened to the recording from my SDRplay receiver and HDSDR, my transmitted audio sounded acceptable.

In early 2014, I asked one of the dealers of the PX-UV973 for an opinion on using this radio to work SO-50 full duplex. I could not get a clear answer on this point for a couple of months, and now I understand why. The PX-UV973 may be a good radio for use with terrestrial repeaters or local simplex activity, but it is a poor performer for any FM satellite work.

Wouxun KG-UV8D

The Wouxun KG-UV8D came on the market around the time of the 2014 Dayton Hamvention. I bought one shortly after that Hamvention. Although it is not capable of being used for full duplex operation with SO-50, I had opportunities to test it against the Fox-1A engineering model at two events later in 2014 (ARRL Centennial Convention in Hartford, 2014 AMSAT Symposium in Baltimore). This radio performed well when I tried it with the Fox-1A engineering model at these events, and I decided to keep it around my shack. With AO-85's launch, it came out of hibernation for my testing. By this time, the KG-UV8D had been replaced by the KG-UV9D, but some dealers still sell the KG-UV8D.

KG-UV8D

I tested my KG-UV8D on some passes during the first weekend after the AO-85 launch, as well as additional passes in late November. I found that I would hear some additional noise in the receiver whenever I transmitted. Not a lot of extra noise, and many times a twist of my antenna would make the additional noise drop in volume. On one pass, I heard what sounded like the Phoenix National Weather Service radio station on 162.550 MHz coming through on 145.980 MHz – a case of signals mixing in the HT's receiver. When I had the antenna lined up with the downlink reasonably well, I was able to hear myself clearly when transmitting through the satellite. The transmit audio recorded by my SDRplay/HDSDR receive station was also acceptable.

I would consider the KG-UV8D as capable of working AO-85 full duplex. Despite the extra noise and mixing I heard when I worked these passes, it was up to the task. Since Wouxun released the KG-UV9D a few months ago, I would not look to buy a new KG-UV8D.

Wouxun KG-UV9D

The Wouxun KG-UV9D hit the market in early 2015, intended to be the replacement for the KG-UV8D. is Currently in production, the KG-UV9D is sold by a variety of dealers in

and outside of the U.S. The U.S. versions have the 2.5 kHz tuning step, where most amateur 2m/70cm FM transceivers have 5 kHz as the smallest tuning step, and default to English on the screen and in the voice prompts when the radio is reset. Other versions of the KG-UV9D available online are made for the Chinese market, where the radio's default language is not English and the radio lacks the 2.5 kHz tuning step.

KG-UV9D.

During the evening of the second day AO-85 was in orbit (Friday, October 9, 2015), I worked two passes using the Wouxun KG-UV9D. The first of the two passes saw AO-85 rise to a maximum of 24 degrees elevation. Around the midpoint of this pass, I completed my first QSO via AO-85 with Tom, KA6SIP, in northern California. I could hear myself through AO-85 while transmitting, and I did not hear any receiver desensing. Later in the evening, I worked another AO-85 pass and logged QSOs with three more California stations.

After AO-85 was commissioned in mid-November, I repeated my test with the KG-UV9D. After a few weeks' experience working this satellite, I wanted to see if I could improve on my October testing results shortly after AO-85 was launched. I was not disappointed. I found I could get access the satellite using a combination of twisting my antenna and taking full advantage of the 2.5 kHz tuning steps for the uplink frequency. One of these mid-November passes was good for my log, with six contacts on a nice coast-to-coast pass.

Even though this radio is incapable of working SO-50 full duplex, it could be used with a second handheld for full duplex operation on that satellite. I do recommend the KG-UV9D as capable of working full duplex on AO-85, as well as any future U/V FM satellite.

To recap, I would rank these four radios in order of their performance, highest to lowest, in working AO-85 full duplex:

1. Wouxun KG-UV9D
2. AnyTone TERMN-8R
3. Wouxun KG-UV8D
4. Puxing PX-UV973

The Chinese-made handhelds have gradually improved their performance over the past few years. In my opinion, a radio amateur can reasonably expect the KG-UV9D to perform better than a radio like the PX-UV973 that has been on the market for a couple of years. Although there are other non-Chinese handhelds that perform better than even the KG-UV9D, like the Kenwood TH-D72A, the KG-UV9D is an option that doesn't come with a $400 price tag like the TH-D72A. I enjoyed using these radios to work AO-85 passes, since my testing confirmed that low-power stations could successfully make contacts on this satellite. It takes a little more planning to work AO-85 with 4-5 W, but it is not impossible.

Notes:

1. A recap of the posts I made to the AMSAT-BB list in October and November 2015 about these four handhelds can be found at: **amsat.org/pipermail/amsat-bb/2015-December/056269.html.**
2. Files from these, and other passes, are available from my Dropbox space at: **dropbox.wd9ewk.net.**

KG-UV9D with SDRplay and tablet.